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LI, JUN				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/597,939

**Applicant(s)**

ZHENG ET AL.

**Examiner**

JUN LI

**Art Unit**

1793

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-37 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-37 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SF/88)  
Paper No(s)/Mail Date \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_.

## **DETAILED ACTION**

### ***Claim Objections***

Claim32 is objected to because of the following informalities: "with" seems missing after "filled". Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 4 and 12-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "dense" in claim 4 and 12-22 is a relative term because the term "dense" is not defined by the claim neither the specification provides a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Thus it renders claim indefiniteness.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

**1. Claims 1-3 and 30, 33 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Sammes (US 6492050).**

Sammes teaches a solid oxide fuel cell system has an array of tubular fuel cells (item 61, Figure 5) comprising a ceramic solid state electrolyte and inner and outer electrode layers (col 2 ln 3-12, 42-47) wherein oxidizing gas entering at one inlet (item 44 figure 5) while fuel gas entering at another inlet (item 45) (col 12 ln 13-23). Sammes also discloses the fuel cell system has a superior heat exchange due to the containment of a combustion chamber (item 41) located in a heat conductive wall (item 48) which is surrounded by an annular space (item 46) serving as the inlet path for one of the reaction gases (col 11 ln 9-15, Figure 5). Sammes teaches that fuel cell is

heated in combustion chamber (col 12 ln 35-41) wherein the fuel can be hydrocarbon-based fuel (col 1 ln 13-15) and that fuel gases are reformed via a reforming catalyst (item 65) located in the annular chamber (item 46) (col 12 ln 15-23, 44-50, Figure 5). Sammes also discloses the fuel cell units can be supported within a thermally insulating container (col 2 ln 51-54) and a manifold for fuel inlets (col 11, Figure 5).

All the recited limitations are disclosed by Sammes, thus the instant claims are either anticipated or obvious over Sammes.

**2. Claim 12-13 and 15 are rejected under 35 U.S.C. 103(a) as obvious over Sammes (US 6492050) in view of Alvin (US2005/0066663).**

The reference of Sammes has been described as above.

Sammes is silent about using a tubular heater with two tubes.

The reference of Alvin has been described as above. Alvin further teaches a tubular combustor that includes an elongated duct for carrying catalyst coated channels (i.e. tubes) inside wherein the catalyst can either coated outside or inside the tube ([Figure 2, 3, [0010], [0025]]). Alvin also discloses different configurations and assembly can be applied to the combustor for one ordinary skill in the art.

It would have been obvious to one ordinary skill in the art to adopt tubular assembly as taught by Alvin to practice the fuel cell combustor of Sammes because the tubular assembly can provide an improved catalyst module for a combustor thus improving the catalyst efficiency as suggested by Alvin([0010], [0006]). Furthermore, adopting known techniques to improve similar method/apparatus is well within the scope of one ordinary skill in the art.

Regarding claim 13, Sammes already teaches the heater located very close the fuel cell and provides a probable temperature for reaction (figure 5, col 11-12).

Regarding claim 15, Alvin further teaches a premixing chamber (item 142) located before the combustor ([0022]) for mixing the fuel and air.

It would have been obvious to one ordinary skill in the art to adopt the premixing chamber as taught by Alvin to modify the heater of Sammes because the premixing chamber can ensure sufficient mixing between air and fuel as suggested by Alvin ([0022]).

**3. Claim 4 and 9-10 are rejected under 35 U.S.C. 103(a) as obvious over Sammes (US 6492050) as applied to claim 1-3, 30, 33 above, and in view of Alvin (US2005/0066663).**

The reference of Sammes has been described as above.

Regarding claim 4 and 9, Sammes is silent about the heater has an inside surface coated with porous catalyst.

Alvin teaches a catalytic combustors comprising tubular subassemblies of catalyst coated channels (item 144) and cooling channels (item 146) ([0022],[0023],[0024], Figure 2, 3). Alvin further discloses coating can be applied to the inside or outside surface of the tube and is a porous structure ([0029]) wherein ceramic materials are often selected as wash coat (i.e. barrier layer) for the metal substrate for the combustor (clm1-17) and the barrier layer with aluminum like material is dense than the catalyst. Alvin further discloses the coating can provide better temperature, oxidation, corrosion resistance to the underlying metal substrate ([0010], [0029]).

It would have been obvious to one ordinary skill in the art to adopt the coating as taught by Alvin to improve the fuel cell heater of Sammes because porous ceramic coating can provide better temperature, oxidation, corrosion resistance for the underlying metal substrate of the combustor (i.e. heater) as suggested by Alvin([0010, [0029]).

Regarding claim 10, Sammes already teaches the recited oxidant chamber (figure 5) in light of the instant specification (page 27, ln 6-7).

**4. Claim 5, 14 and 18-20, 22-23, 25 are rejected under 35 U.S.C. 103(a) as obvious over Sammes (US 6492050) or Sammes in view of Alvin (US2005/0066663) as applied to claim 1-4, 9-10, 30, 33 above, and further in view Shen (CN85100996).**

Regarding claim 5, 14, 23 and 25, the references of Sammes and Alvin are silent about the heater tube has a porous wall.

Shen teaches heater can be made from porous member with higher heat emission coefficient thus reduce heat transfer area and reduce effective temperature differences (abstract).

It would have been obvious to one ordinary skill in the art to adopt the porous heater tube as taught by Shen to modify the heater of Sammes in view of Alvin because porous heater can provide higher heat coefficient thus reduce heat transfer area and lower expenses of both metal and energy as suggested by Shen (abstract).

It is to be noted that the Sammes in view of Alvin already teaches coating the metal surface with catalytic component and the fuel and air passing through the pores is thus expected.

Regarding claim 18-20, the references of Sammes, Alvin and Shen is not expressly teaching the heater having a third tubes there.

However, Alvin clearly indicates that tubes shall encompass other ducts or other conduits of any geometric shape that can be employed for providing a better catalyst module for the combustor ([0030]) wherein the tube is enclosed by an outer tube (figure 2, 3). Therefore, the recited third inner tube is just an expected modification because one of ordinary skill in the art would have been obvious to adopt a third tube inside the catalyst coated tubes (item 144) for a better catalytic performance with better temperature, corrosion, and oxidation resistance for the metal substrate of the tube ([0010]). Furthermore, the recited function associated with the apparatus is either expected or obvious over the prior arts because similar structure of the recited combustor has been disclosed therein (See § MPEP 2114).

Regarding claim 22, Alvin already teaches catalyst can be coated in the surface of the heater tube as discussed above.

**5. Claim 31 and 32 are rejected under 35 U.S.C. 103(a) as obvious over Sammes (US 6492050) as applied to claim 1-4, 9-10, 30, 33 above, and further in view of Kim (US5932181).**



Regarding claim 32 and 33, it is to be noted that the catalytic combustor can be read onto the reformer because fuel such as hydrocarbon will be reformed there by catalyst as disclosed by Sammes in view of Alvin.

The references of Sammes and Alvin are silent about the reformer filled with catalyst.

Kim teaches reformer can be filled with catalyst (item 110) in the annular space (Figure 2, col 5 ln 30-32, clm1).

It would have been obvious to one ordinary skill in the art to adopt the catalyst filled in the annular space as taught by Alvin to modify the combustor of Sammes in view of Alvin because adopting known technique for improving efficiency of similar method/apparatus is well within the scope of one ordinary skill in the art.

**6. Claim 7 is rejected under 35 U.S.C. 103(a) as obvious over Sammes (US 6492050) in view of Alvin (US2005/0066663) as applied to claim 1-4, 9-10, 30, 33 above, and further in view Yamamoto (US2004/0105789).**

The references of Sammes and Alvin are silent about using resistive heating element.

Yamamoto teaches using resistive element for providing enough heat for the catalytic reaction ([0085]).

It would have been obvious to one ordinary skill in the art to adopt the resistive heating as taught by Yamamoto to modify the combustor of Sammes in view of Alvin because resistive heating can provide heating for the catalytic combustion reaction as

suggested by Yamamoto ([0085]) while Sammes in view of Alvin need a means for heating the combustor without specific describing one.

**7. Claim 6, 8, 11 and 16-17, 27-29 are rejected under 35 U.S.C. 103(a) as obvious over Sammes (US 6492050) or Sammes in view of Alvin (US2005/0066663) as applied to claim 1-4, 9-10, 30-33 above, and further in view Haltiner (US2003/0235732).**

Regarding claim 6, 8, 16-17 and 27, the references of Sammes and Alvin are silent about the heater filled with a porous flame arrester and comprising a flame burner.

Haltiner teaches an igniter (item 79) can start the ignition of the system while a porous flame arrester (item 1136) prevents flashback from the reformer (item 106) into combustor chamber (item 77) (Figure 20, [0071], [0072]).

It would have been obvious to one ordinary skill in the art to adopt the porous flame arrester and igniter as taught by Haltiner to modify the heater of Sammes in view of Alvin because flame arrester can prevents flashback from the reformer into combustor chamber while igniter can igniting mixed fuel and air as suggested by Haltiner ([0071]). It is to be noted as a porous flame arrester, a pore size already associated with it. One of ordinary skill in the art would have been obvious to choose a probable size to ensure a desired flame arresting function.

Regarding claim 11, Alvin already teaches different types of porous ceramic material such as aluminum can be used as the catalyst support and barrier layer in the combustor as discussed above which read onto the foam matrix recited in the instant application in light of the instant specification (page 22 ln 1-8, page 28 ln 21-24).

Furthermore, the recited material cannot distinguish the claimed apparatus from the prior art (See § MPEP 2114).

Regarding claim 28, it is to be noted that the recited function is expected because prior arts already disclosed a porous flame arrester. Furthermore, it is to be noted that the claimed apparatus can only be distinct from the prior art from the recited structure but not the related function (See § MPEP 2114).

Regarding claim 29, Alvin already teaches a porous catalytic coating can be inside/outside the surface of a tube as discussed above. Thus the recited limitation is just an obvious modification over the prior arts.

**8. Claim 21, 24, 26 and 35-37 are rejected under 35 U.S.C. 103(a) as obvious over Sammes (US 6492050) or Sammes in view of Alvin (US2005/0066663) and Shen (CN85100996) as applied to claim 1-5, 9-10, 23, 25, 30, 33 above, and further in view of Haltiner (US2003/0235732) .**

Regarding claim 21, 24, 26 and 35, the references of Sammes, Alvin and Shen are silent about the flame igniter.

Haltiner has been described as above.

It would have been obvious to one ordinary skill in the art to adopt the porous flame arrester and igniter as taught by Haltiner to modify the combustor of Sammes in view of Alvin and Shen because flame arrester can prevents flashback from the reformer into combustor chamber while igniter can igniting mixed fuel and air as suggested by Haltiner ([0071]). Haltiner is silent about the specific shape of the flame arrester, however, one of ordinary skill in the art would have been obvious to adopt a

probable shape such as recited in the instant claims to practice the flame arresting function. Furthermore, no unexpected results are associated with the recited tubular shape.

Regarding claim 36 and 37, Alvin already teaches the heater tube can be coated with catalytic material as discussed above.

**9. Claim 34 is rejected under 35 U.S.C. 103(a) as obvious over Sammes (US 6492050) in view of Shen (CN85100996) as applied to claim 1-5, 9-10, 23, 25, 30, 33 above, and further in view of Yamamoto (US2004/0105789).**

The references of Sammes and Shen are silent about the flame igniter.

Yamamoto has been described as above.

It would have been obvious to one ordinary skill in the art to adopt the resistive heating as taught by Yamamoto to modify the combustor of Sammes in view of Shen because resistive heating can provide heating for the catalytic combustion reaction as suggested by Yamamoto ([0085]) while Sammes in view of Shen need a means for heating the combustor without specific describing one.

### ***Conclusion***

All the claims are rejected for the reasons of the record.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JUN LI whose telephone number is (571)270-5858. The examiner can normally be reached on Monday-Friday, 8:00am EST-5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JUN LI/

Examiner, Art Unit 1793

/J. L./

06/25/2009

/Melvin Curtis Mayes/

Supervisory Patent Examiner, Art Unit 1793